

FLETCHER et al
Appl. No. 10/574,232
March 5, 2009

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AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1 (currently amended). A method for reducing the viscosity of a viscous composition which is arranged to flow along a fluid flow path, said method comprising contacting the viscous composition in said fluid flow path with a treatment fluid formulation, said treatment fluid formulation comprising a polymeric material AA which includes -O- moieties pendent from a polymeric backbone thereof, wherein polymeric material AA is optionally cross-linked and wherein said treatment fluid formulation is initially contacted with said viscous composition in said fluid flow path at or downstream of a producing face of a subterranean formation.

2 (original). A method according to claim 1, wherein the viscosity of the viscous composition after contact with the treatment fluid formulation is less than 300cP measured at 25°C and 1000s⁻¹.

3 (previously presented). A method according to claim 2, wherein the viscous composition, after contact with the treatment fluid formulation, exhibits shear thinning.

4 (previously presented). A method according to claim 1, wherein said viscous composition is an oil.

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5 (canceled).

6 (currently amended). A method according to claim 5 1, wherein said fluid flow path is defined by a conduit means which includes a first conduit part which is arranged downstream of a production means.

7 (previously presented). A method according to claim 1, wherein said fluid flow path extends between a first point, remote from the point of production of the viscous composition, and a second point closer to the point of production of the viscous composition.

8 (previously presented). A method according to claim 1, wherein said fluid flow path is defined, in part, by a second conduit part which extends upwardly from below ground to above ground.

9 (previously presented). A method according to claim 1, wherein said treatment fluid formulation is arranged to disperse and/or emulsify said viscous composition on contact therewith.

10 (previously presented). A method according to claim 1, wherein flow is turbulent at the point of initial contact of said viscous composition with said treatment fluid formulation so that said composition is dispersed and/or emulsified on contact with said formulation.

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11 (previously presented). A method according to claim 1, wherein a delivery flow path is defined which is arranged to communicate with said fluid flow path wherein said treatment fluid formulation is dosed into said viscous composition in said fluid flow path via said delivery flow path.

12 (previously presented). A method according to claim 11, wherein the ratio of the flow rate (in weight per unit time) of treatment fluid formulation in said delivery flow path to the flow rate (in the same units) of viscous composition in said fluid flow path is in the range 0.1 to 2.5.

13 (previously presented). A method according to claim 12, wherein the amount of water in the composition in said fluid flow path immediately after contact between said viscous composition and said treatment fluid formulation is less than 70wt%.

14 (previously presented). A method according to claim 1, wherein said treatment fluid formulation has a viscosity at 25°C and 1000s⁻¹ of greater than 1cP and not greater than 50cP.

15 (previously presented). A method according to claim 1, wherein said treatment fluid formulation includes at least 70wt% water.

16 (previously presented). A method according to claim 15, wherein said

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treatment fluid formulation includes at least 0.2wt% and less than 10wt% of said polymeric material AA.

17 (currently amended). A method according to claim 5 1, wherein said treatment fluid formulation includes 94.5 to 99.6wt% water and 0.4 to 5.5wt% of said polymeric material AA; and the ratio of the wt% of said treatment fluid formulation to the wt% of said viscous composition contacted in the method is in the range 0.4 to 0.9.

18 (previously presented). A method according to claim 1, wherein said polymeric material AA is wholly soluble in water at 25°C.

19 (previously presented). A method according to claim 1, wherein said polymeric backbone of said polymeric material AA includes carbon atoms which are part of -CH₂- moieties.

20 (previously presented). A method according to claim 2, wherein said polymeric backbone consists essentially of carbon atoms in the form of C-C single bonds.

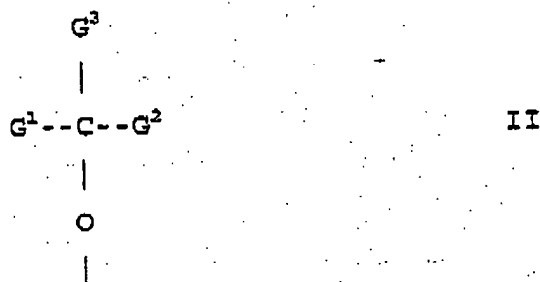
21 (previously presented). A method according to claim 4, wherein said treatment fluid formulation includes a hydrogel which is an optionally cross-linked polysaccharide, polyvinylalcohol or polyvinylacetate.

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22 (previously presented). A method according to claim 1, wherein said -O- moieties are directly bonded to the polymeric backbone.

23 (previously presented). A method according to claim 4, wherein said polymeric material AA includes, on average, at least 10 -O- moieties pendent from the polymeric backbone thereof.

24 (previously presented). A method according to claim 4, wherein said polymeric material AA includes a moiety:



where G^1 and G^2 are other parts of the polymeric backbone and G^3 is another moiety pendent from the polymeric backbone.

25 (previously presented). A method according to claim 4, wherein at least 60 mole% of the polymeric material AA comprises vinyl moieties which are optionally cross-linked.

26 (previously presented). A method according to claim 4, wherein the free bond

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to the oxygen atom in the -O- moiety pendent from the polymeric backbone of polymeric material AA is bonded to a group R^{10} which comprises fewer than 10 carbon atoms and only includes atoms selected from carbon, hydrogen and oxygen atoms.

27 (original). A method according to claim 26, wherein moiety -O- R^{10} in said polymeric material AA is an hydroxyl or acetate group.

28 (previously presented). A method according to claim 1, which involves selecting a said polymeric material AA; selecting a material BB which includes a functional group which is able to react in the presence of said polymeric material AA to cross-link polymeric material AA and form a polymeric material CC; and causing the formation of said polymeric material CC by a reaction involving said polymeric material AA and material BB.

29-30 (cancelled).

31 (previously presented). A method according to claim 28, wherein material BB has a general formula:

CHO

|

G⁵

|

CHO

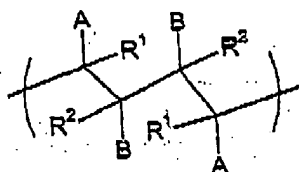
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where G^5 represents a direct link or a linking moiety.

32-35 (cancelled).

36 (previously presented). A method according to claim 28, wherein said material BB comprises:

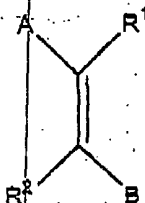
(i) a first polymeric material having a repeat unit of formula



wherein A and B are the same or different, are selected from optionally-substituted aromatic and heteroaromatic groups and at least one comprises a relatively polar atom or group and R^1 and R^2 independently comprise relatively non-polar atoms or groups; or

(ii) a first polymeric material prepared or preparable by providing a compound of general formula

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wherein A, B, R¹ and R² are as described above, in an aqueous solvent and causing the groups C=C in said compound to react with one another to form said first polymeric material.

37 (cancelled).

38 (previously presented). A method according to claim 4, wherein after the viscous composition has been delivered to a desired location the viscous composition is caused to separate from other components of the treatment fluid formulation.

39 (original). A method according to claim 38, wherein separation is achieved by reducing mixing or turbulent movement of the mixture and allowing the viscous composition to settle out from the water and optionally cross-linked polymeric material AA.

40-43 (cancelled).

44 (currently amended). A method of reducing the viscosity of a viscous petroleum which is arranged to flow along a fluid flow path, said method comprising contacting the viscous petroleum with a treatment fluid formulation, wherein:

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- a delivery flow path is defined which is arranged to communicate with said fluid flow path, said treatment fluid formulation being dosed into said viscous petroleum in said fluid flow path via said delivery flow path;

- the treatment fluid formulation is initially contacted with said viscous composition in said fluid flow path at or downstream of a producing phase of a subterranean formation;

- the ratio of the flow ratio (in weight per unit time) of treatment fluid formulation in said delivery flow path to the flow rate (in the same weight per unit time units) of viscous petroleum in said fluid flow path is in the range 0.1 to 2.5;

- said treatment fluid formulation includes at least 90wt% water and at least 0.2wt% of a polymeric material AA;

- said polymeric material AA is a polyvinylalcohol polymer or copolymer.

45 (previously presented). A method according to claim 44, wherein:

- said ratio of said flow rates is in the range 0.2 to 1;

- said treatment fluid formulation includes at least 0.5wt% and less than 5.5wt% of said polymeric material AA.

46 (currently amended). A method according to claim ~~45~~ 44, wherein immediately after contact between said viscous petroleum and said treatment fluid formulation, said fluid flow path contains a composition which includes 40 to 80wt% of material derived from said viscous petroleum and 20 to 60wt% of material derived from said treatment fluid formulation.

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47 (previously presented). A method according to claim 46, wherein said polymeric material AA comprises polyvinylacetate which has been 60 to 90% hydrolysed to polyvinylalcohol.

48 (currently amended). A fluid flow path ~~which~~ positioned at or downstream of a producing face of a subterranean formation, wherein said flow path contains a fluid comprising petroleum, water and a polymeric material AA which is a polyvinyl alcohol polymer or copolymer which is not cross-linked.

49 (previously presented). A fluid flow path according to claim 48, said fluid flow path containing a composition which includes 40 to 80wt% of material derived from a viscous petroleum and 20 to 60wt% of water.

50 (canceled).